

Trends in Adult Coho and Chinook Salmon Life History at the University of Washington's Hatchery

Thomas Quinn, Jeramie Peterson and Vincent Gallucci
School of Aquatic and Fishery Sciences
University of Washington
Seattle, WA 98195
email: tquin@fish.washington.edu

Abstract

The declines in abundance of Pacific salmon in the northwest have greatly increased the need to fully understand the status and trends of species and populations in the region and especially Puget Sound over the past several decades. To advance our state of understanding, we examined detailed data on the University of Washington hatchery populations of coho and chinook salmon, recorded since the late 1950s. Specifically, we assessed trends in timing of spawning, body size (length and weight) and reproductive traits (fecundity and egg size). The date of spawning for both species (but particularly coho salmon) occurred earlier over the years but seems to have stabilized in recent years. Salmon of both species have declined in average length and weight over the entire period of record but since the late 1970s both species (especially coho) have also gotten thinner (i.e., lighter for a standard length). The patterns of fecundity at a standard length parallel those of weight; fecundity at length increased until about 1980 and decreased thereafter. An opposite pattern was observed in egg size; lately salmon (especially coho) are relatively small but are producing large eggs for their body size and consequently far fewer eggs than in the past (over 3000 per female around 1970 to under 2000 lately). Condition factor, and fecundity of both species showed declines over the past several decades, notably since the late 1970s or about 1980. The incidence of jacks has varied considerably from year to year but two age groups of jacks are seen in chinook. Age-2 jacks were most abundant until the late 1970s, when they decreased and age-1 jacks became more common. Overall, the results point to some trends, notably timing, that are probably related to practices in the hatchery and other trends, notably size and reproductive traits, that may reflect a mix of condition of the salmon when released and the environmental conditions that they experienced at sea. Further analysis will be designed to disentangle these factors.

**Trends in timing, size and
reproductive traits of UW coho and
chinook salmon**

**Thomas Quinn, Jeramie Peterson and
Vincent Gallucci**

With thanks to:

**Glenn Yokoyama and Mark Tetrick,
hatchery managers**

**Lauren Donaldson, Ernest Brannon and
William Hershberger, professors**

Background: Many salmon populations have undergone declines in survival, body size, or other life history traits

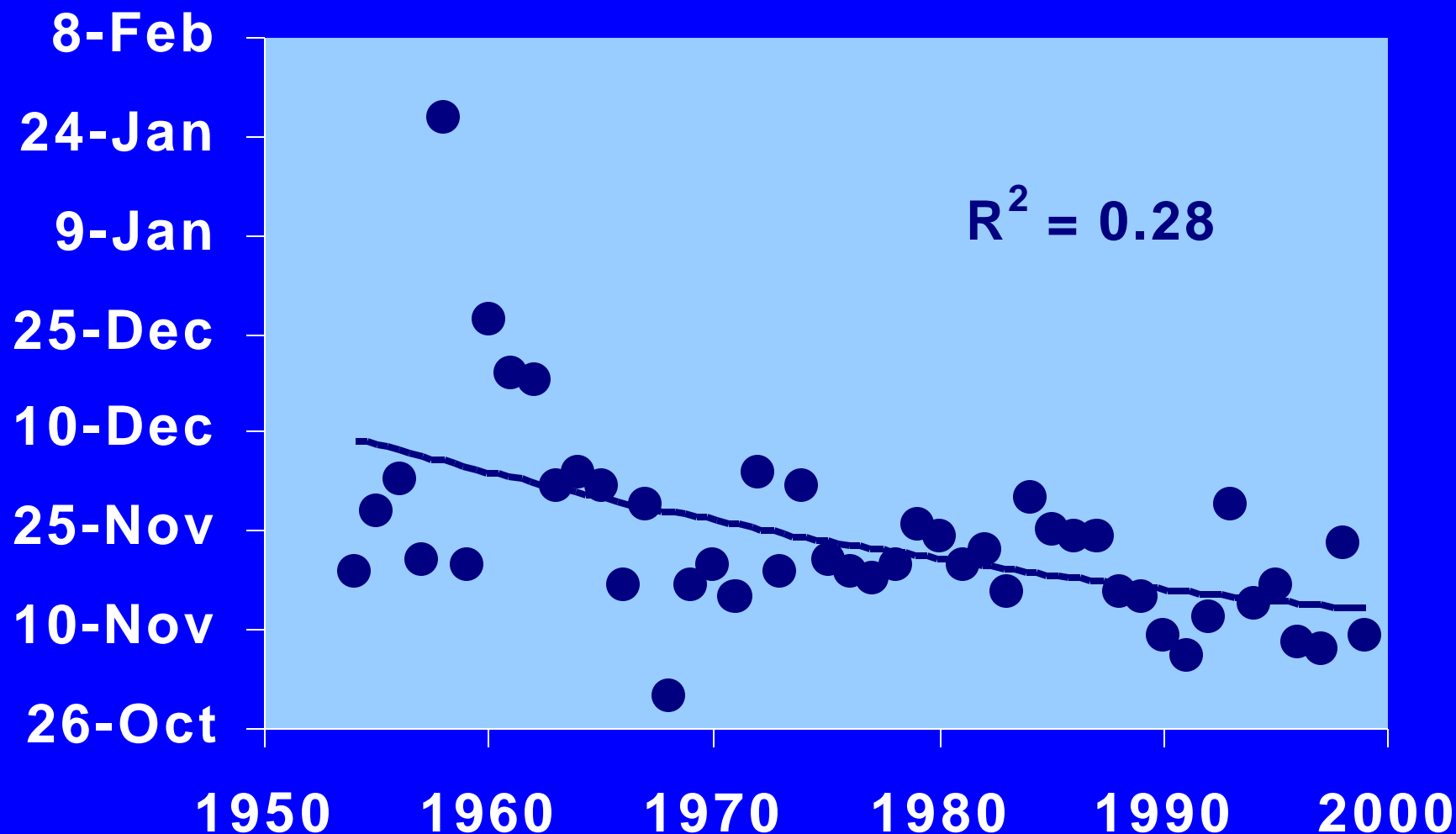
Problem: Few populations are sufficiently well studied to reveal the changes in these traits over decades

Objective: To examine detailed records on body size, female reproductive traits and survival in a single population

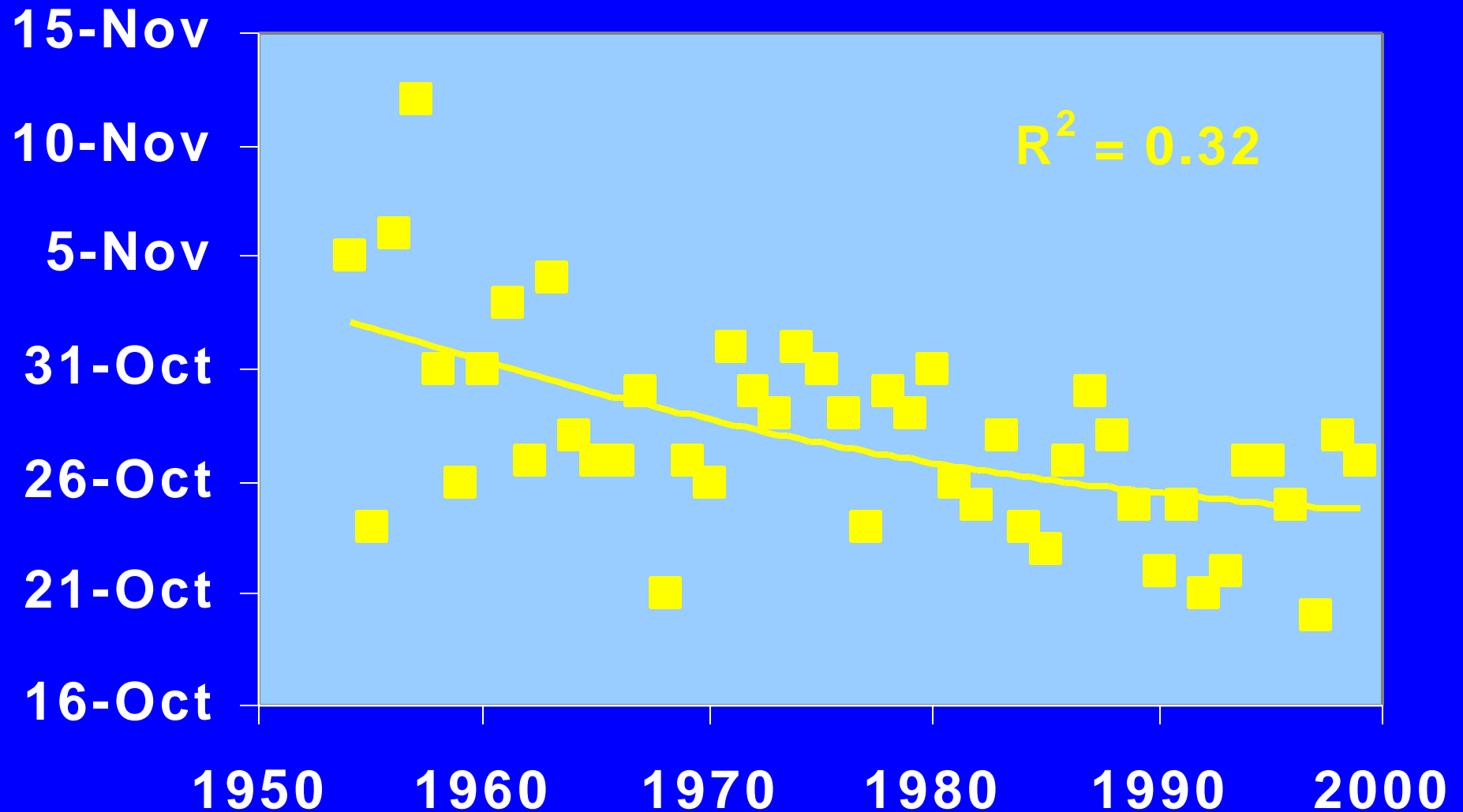
Hypotheses to be tested:

- 1. Spawning date has gotten later for chinook and earlier for coho salmon**
- 2. Length at age has declined**
- 3. Weight at length has declined**
- 4. At small body sizes, fecundity was sacrificed to maintain minimal egg size**

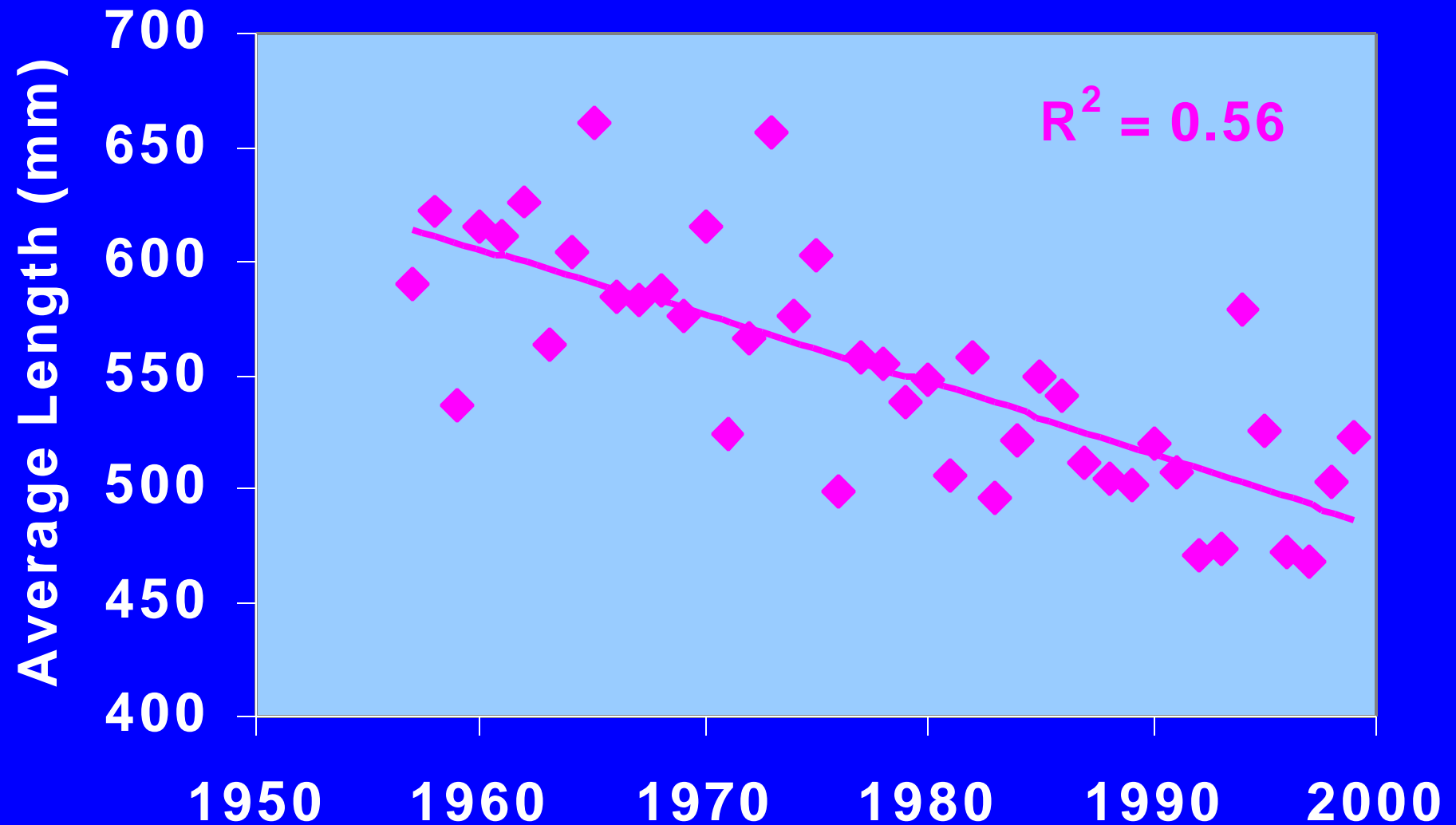
Median spawning date of UW coho salmon



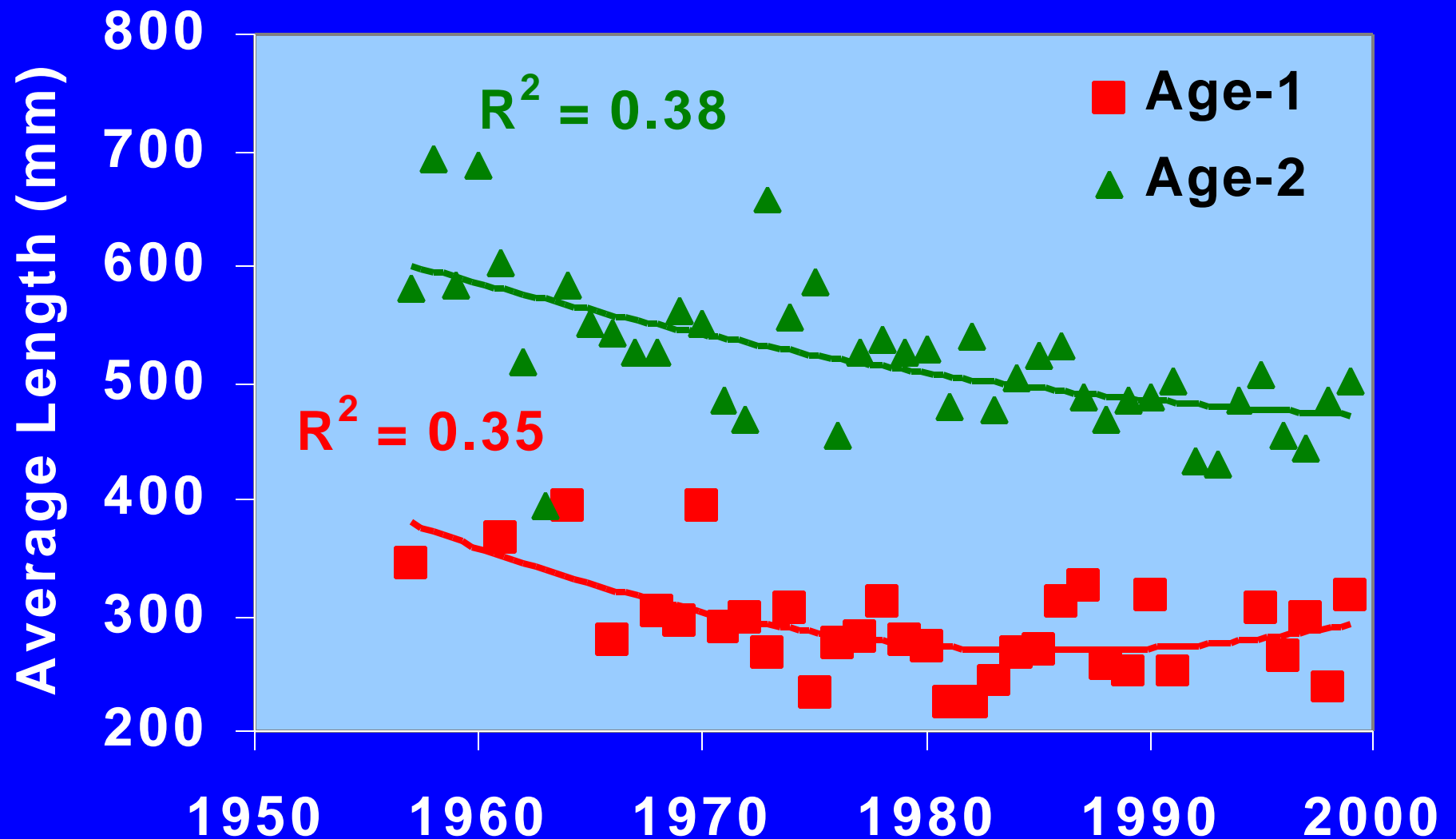
Median spawning date of UW chinook salmon



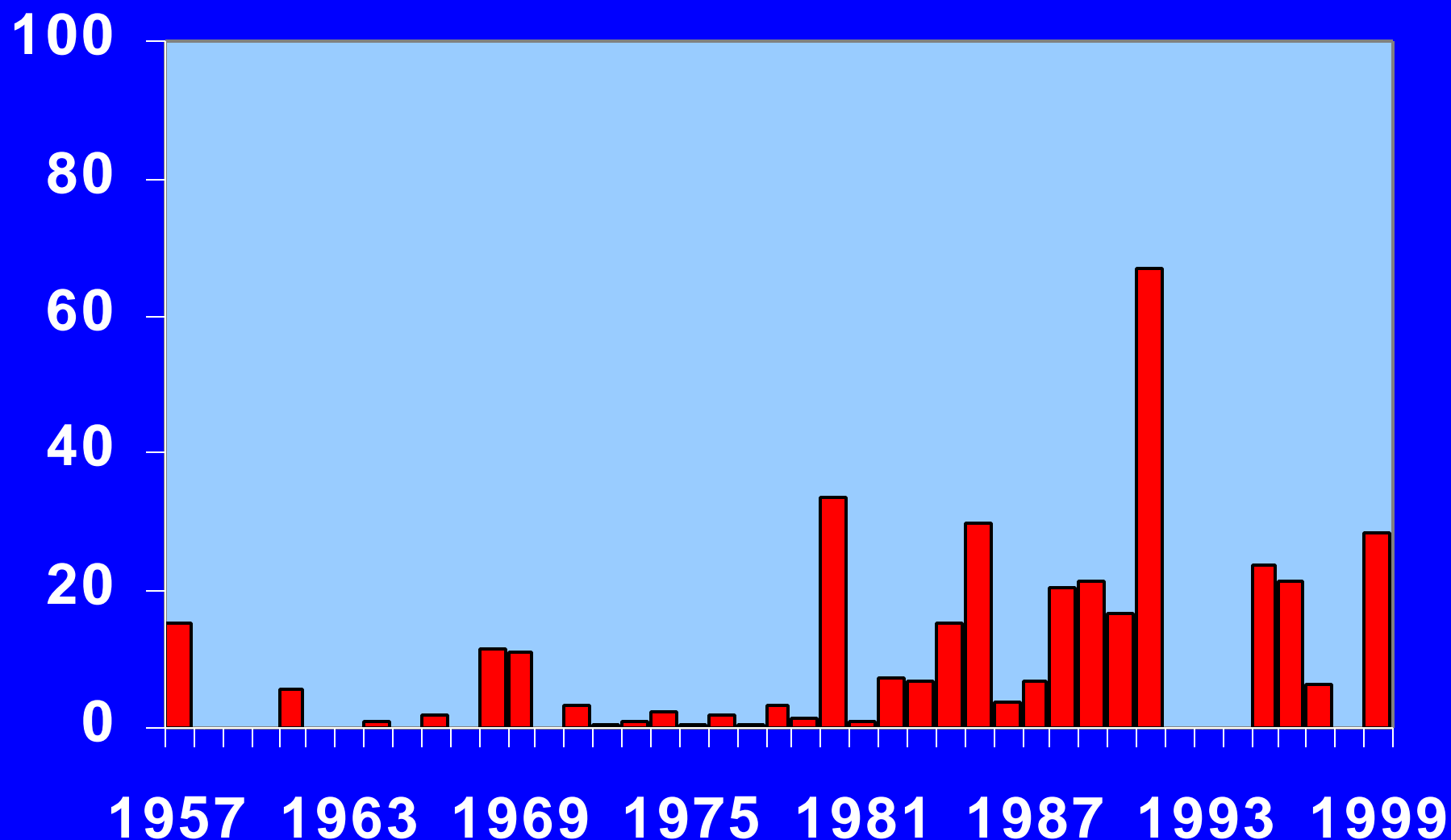
Length at age trends in UW female coho salmon



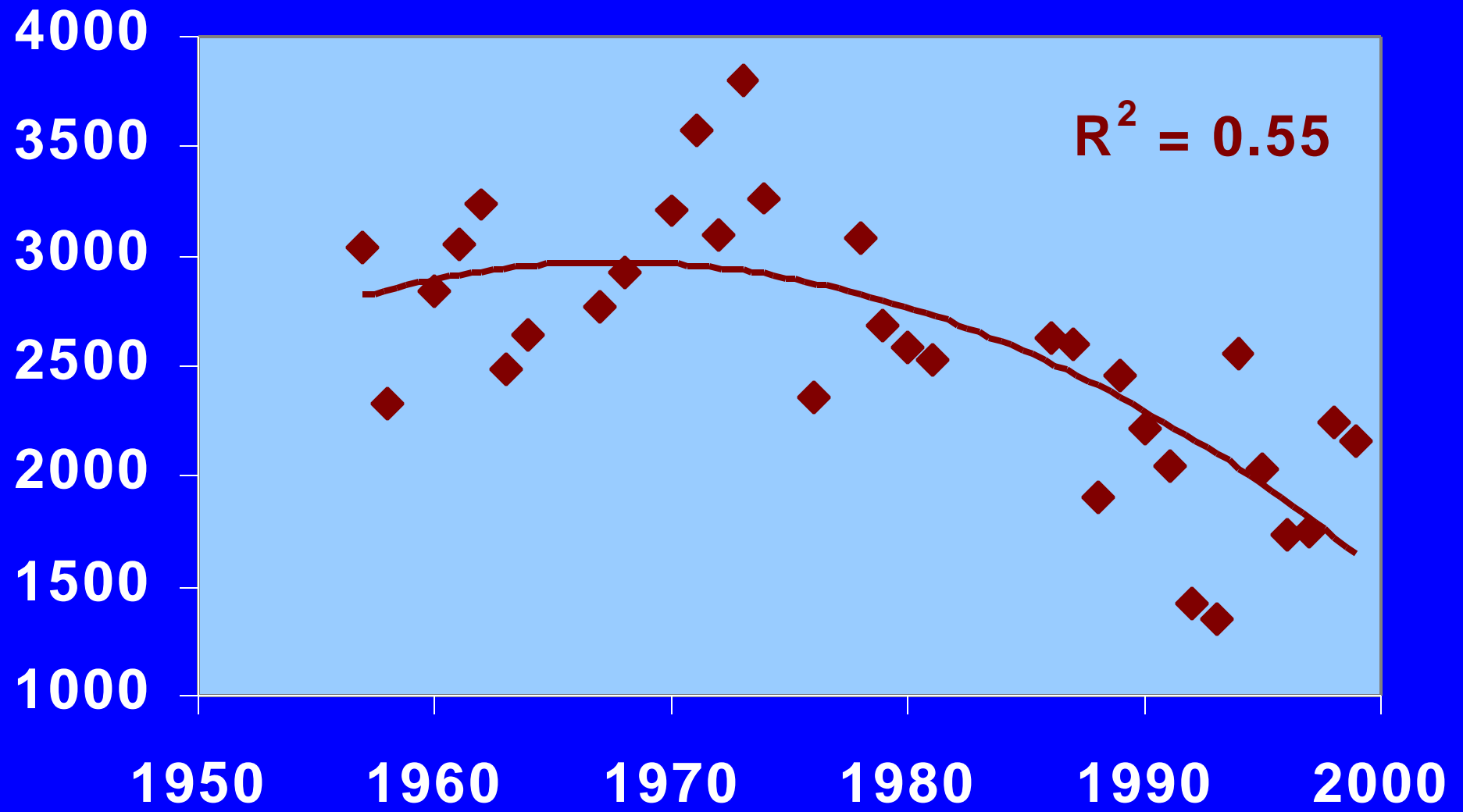
Length at age of UW male coho salmon



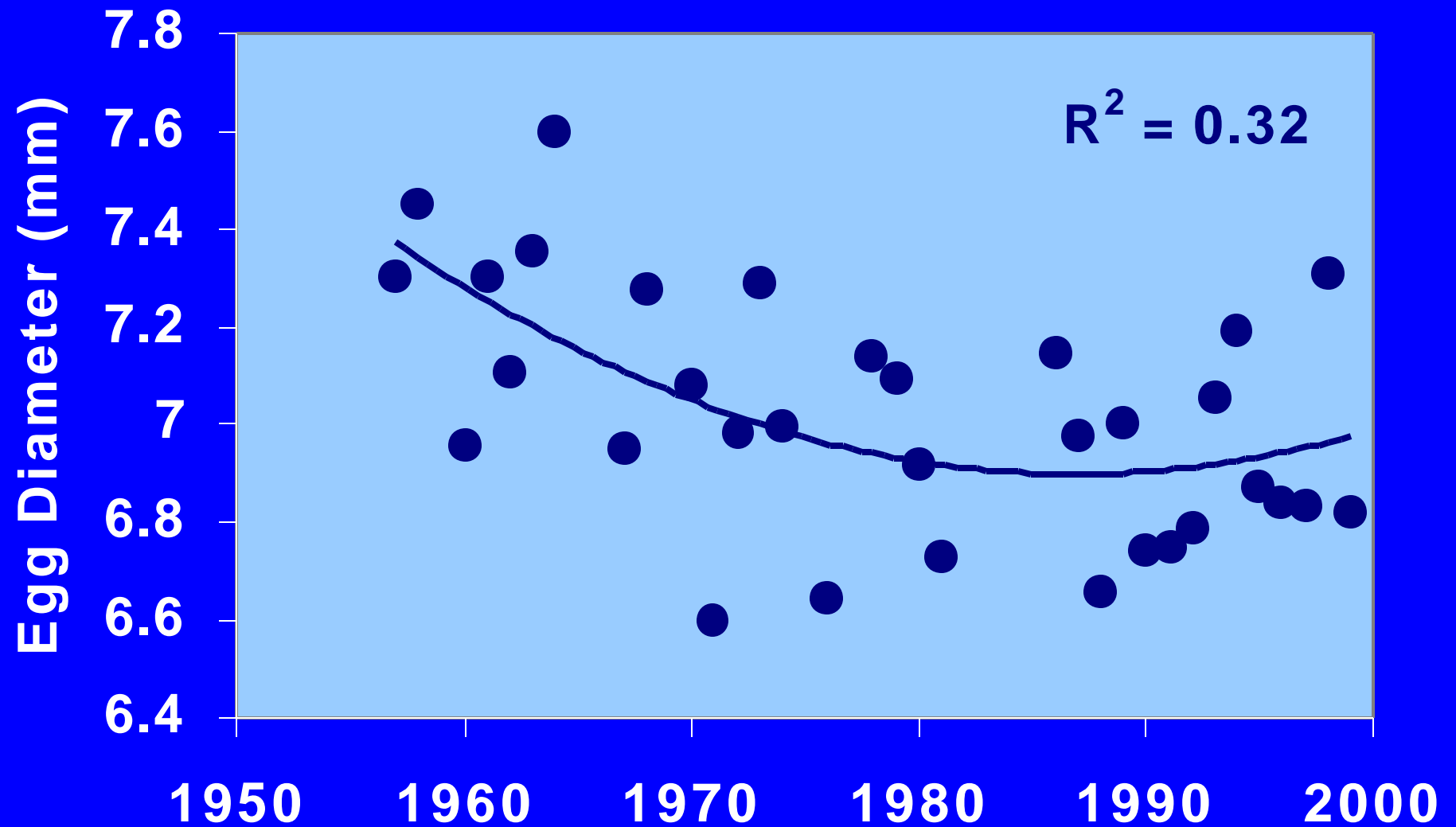
Percentage of jacks among male UW coho salmon



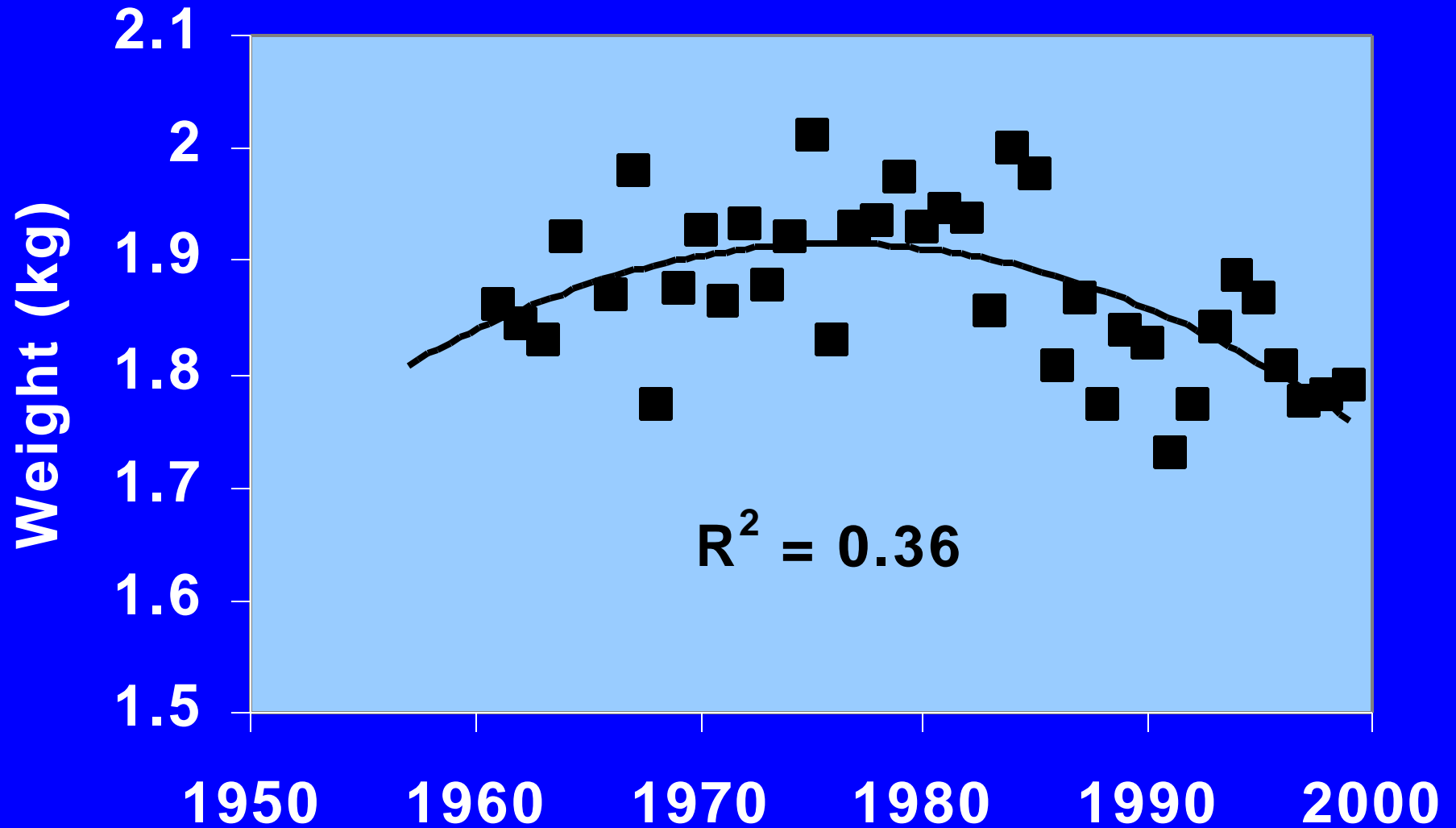
Average fecundity of UW coho salmon



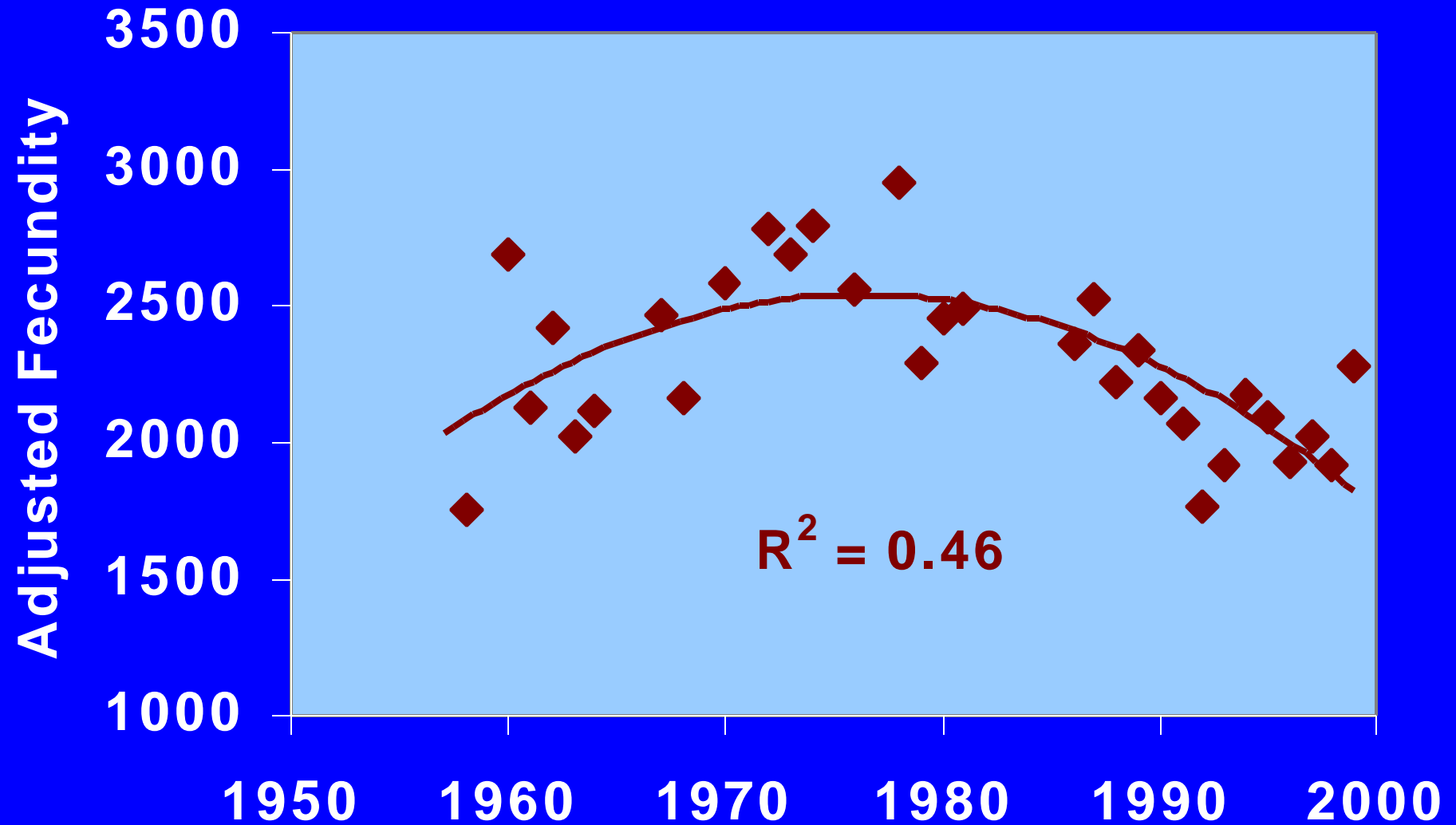
Average size of UW coho salmon eggs



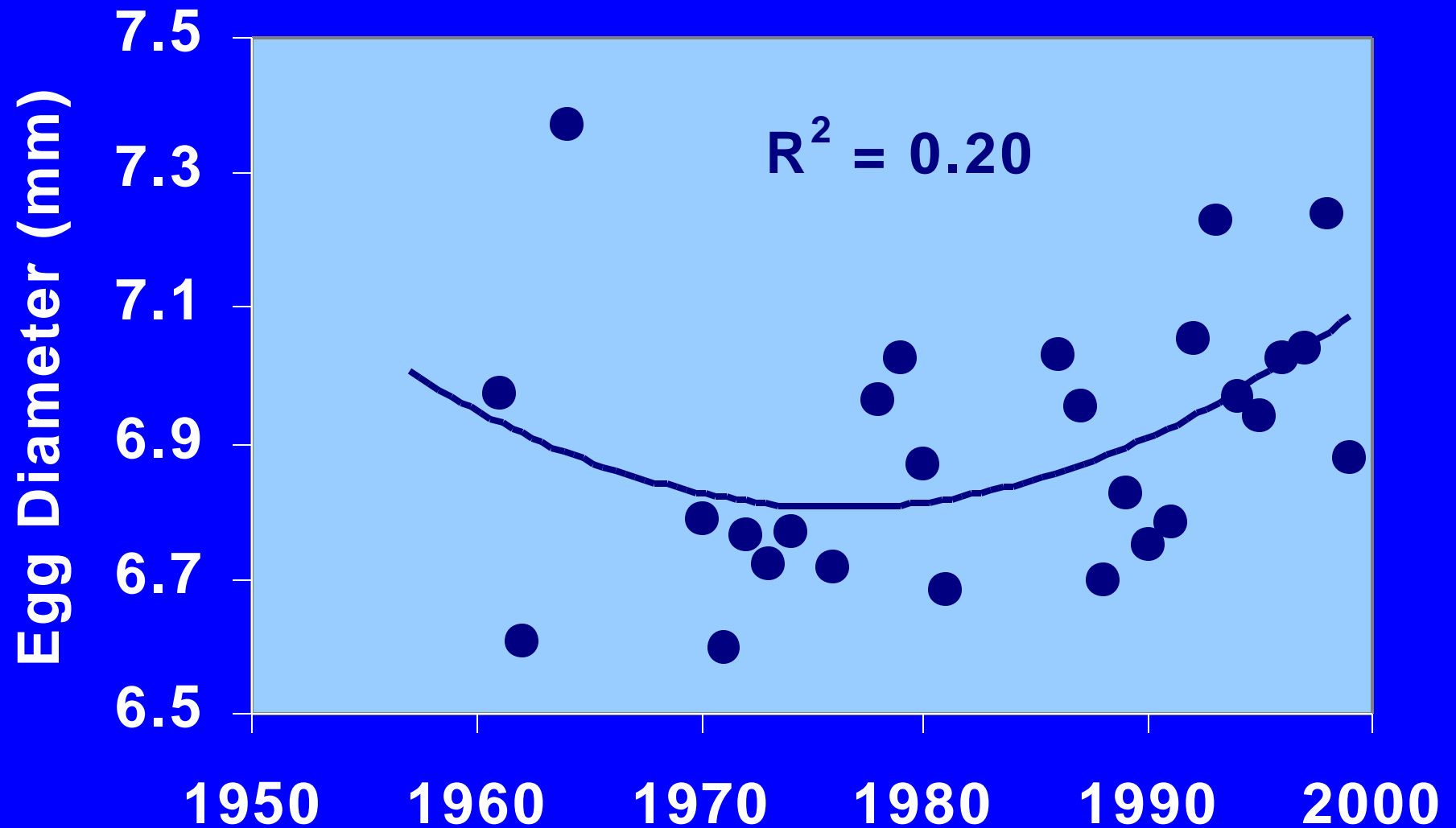
Average weight of UW female coho salmon at a standard length of 545 mm



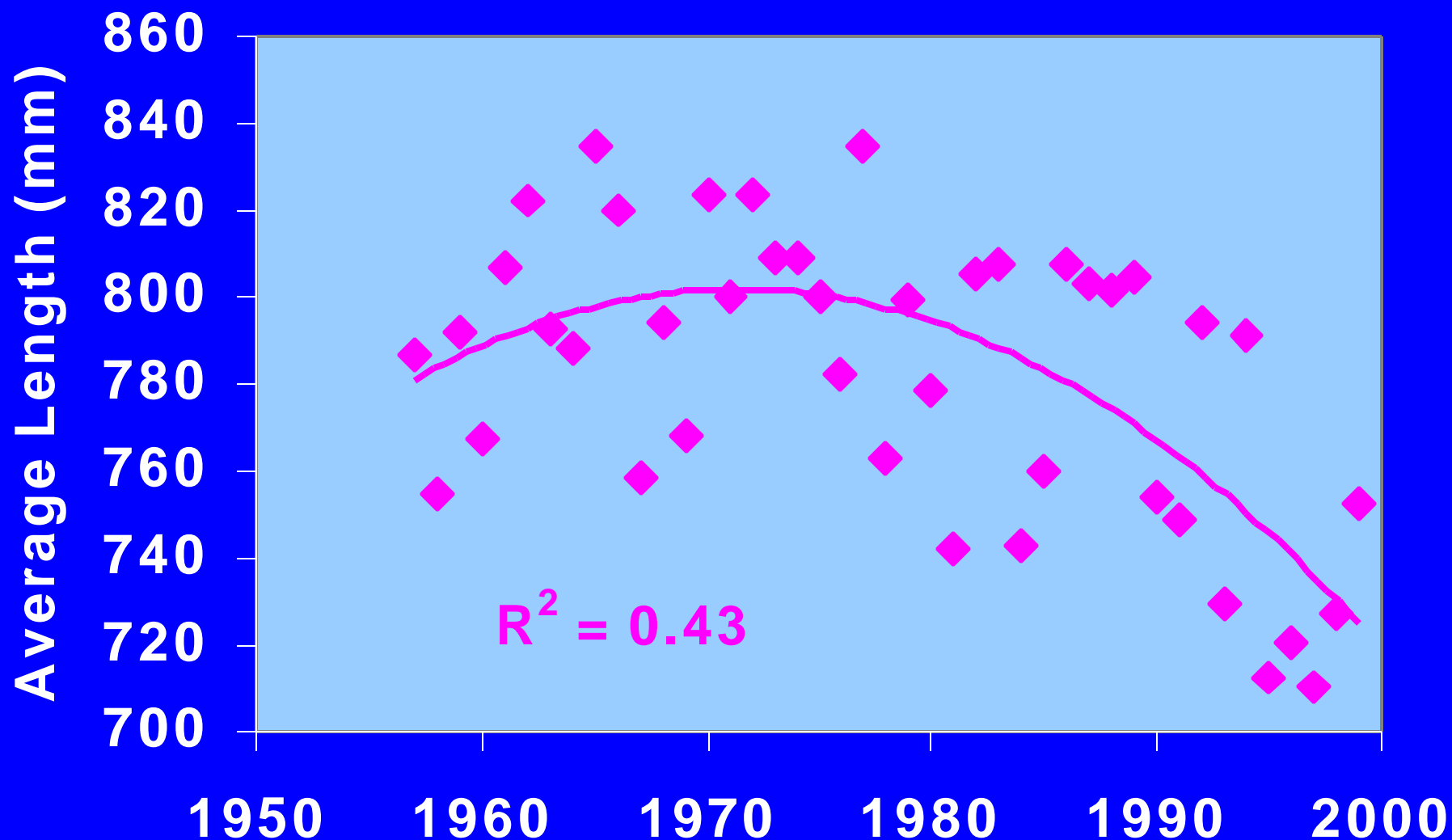
Average fecundity of UW coho salmon at a standard length of 545 mm



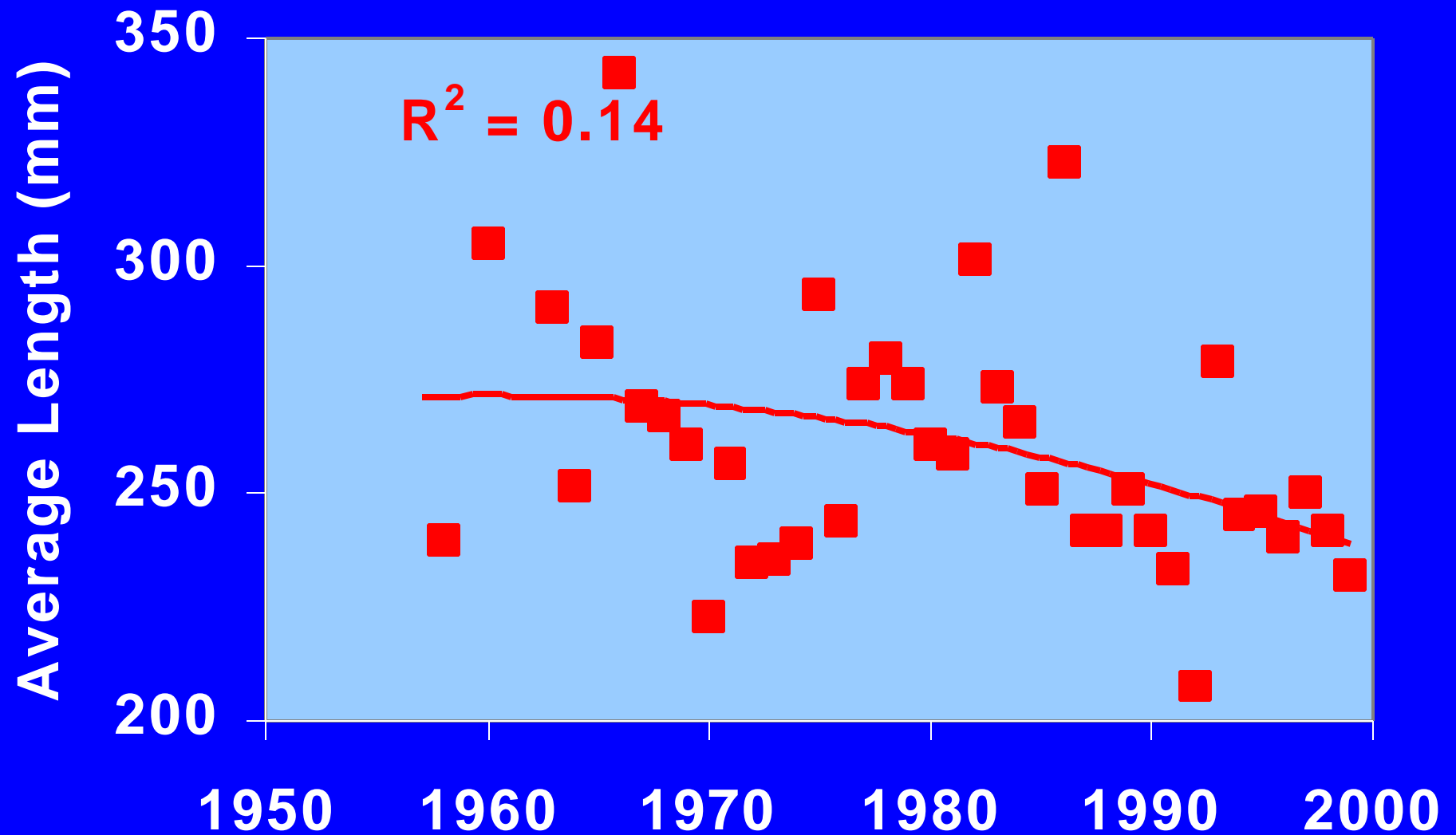
Average egg size of UW coho salmon at a standard length of 545 mm



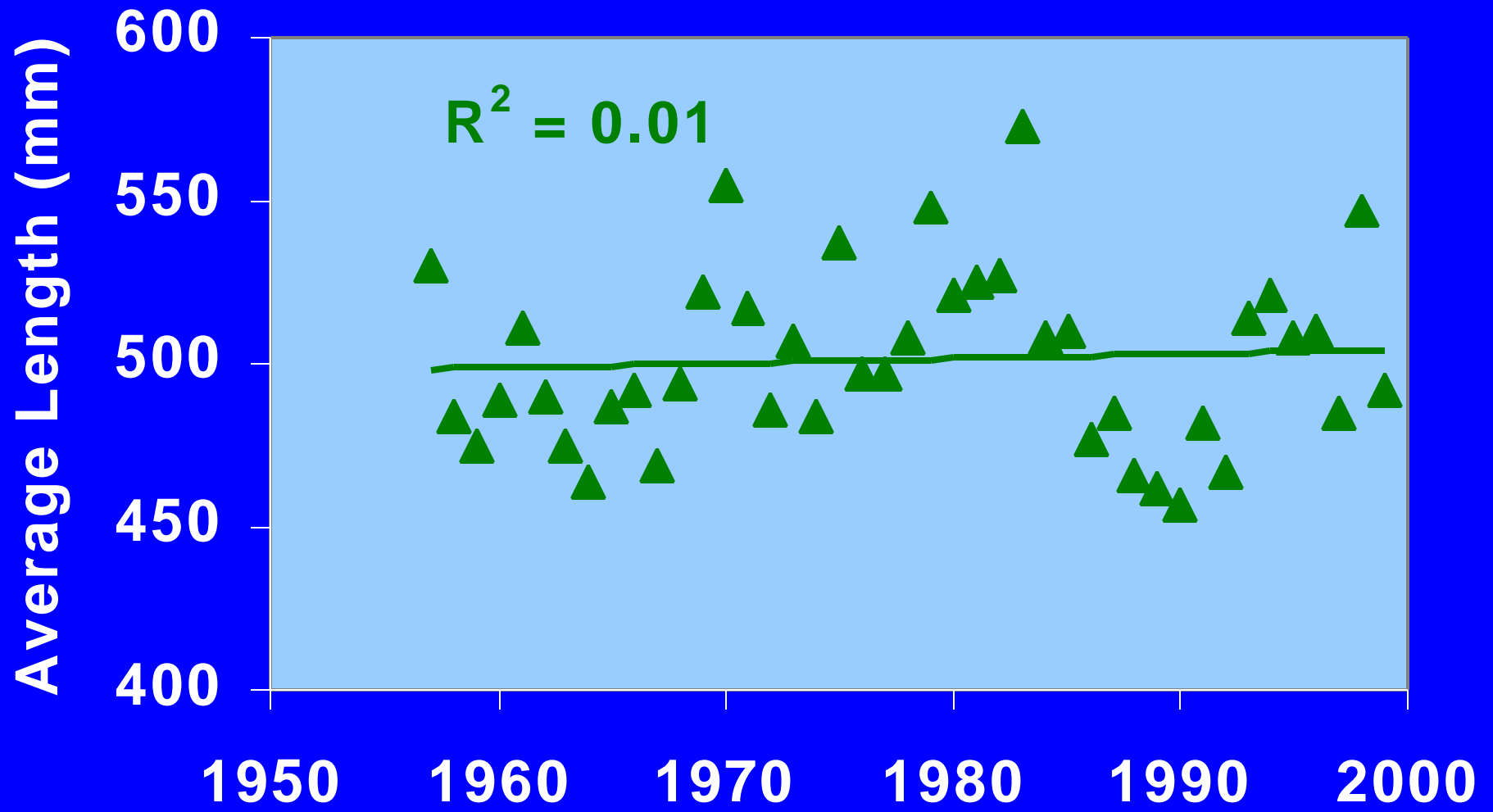
Length of female age 3 + UW chinook salmon



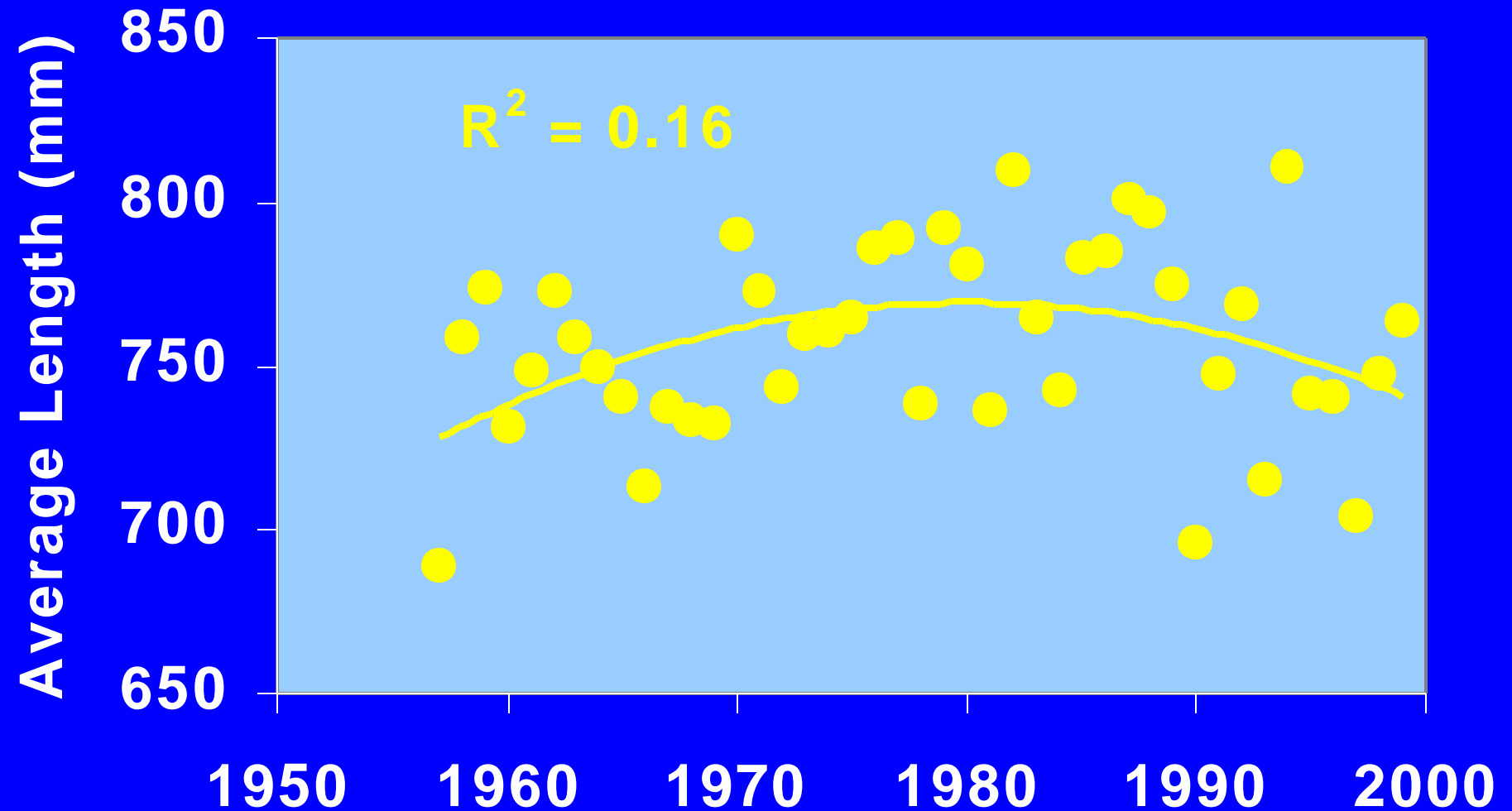
Length of male age 1 UW chinook salmon



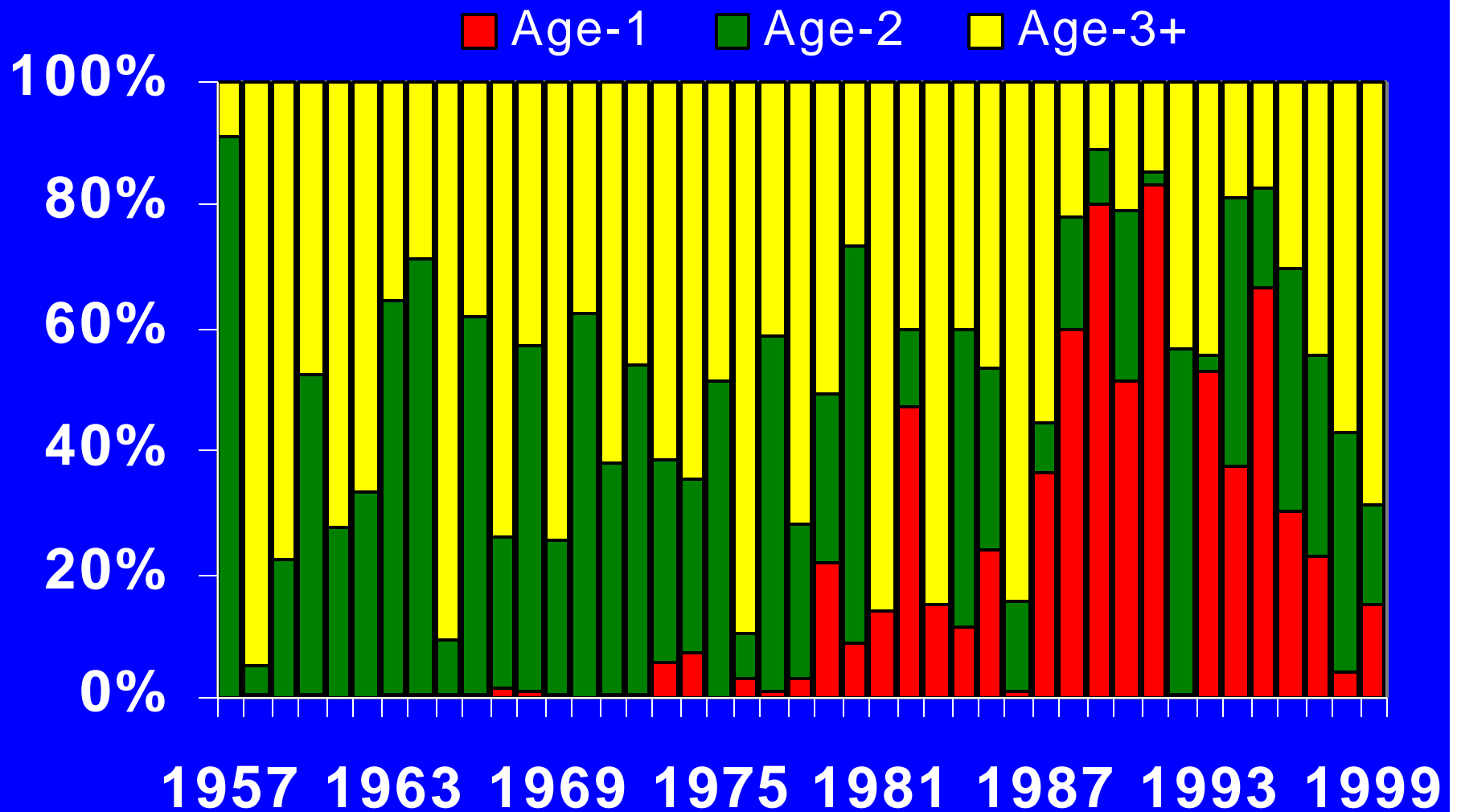
Length of male age 2 UW chinook salmon



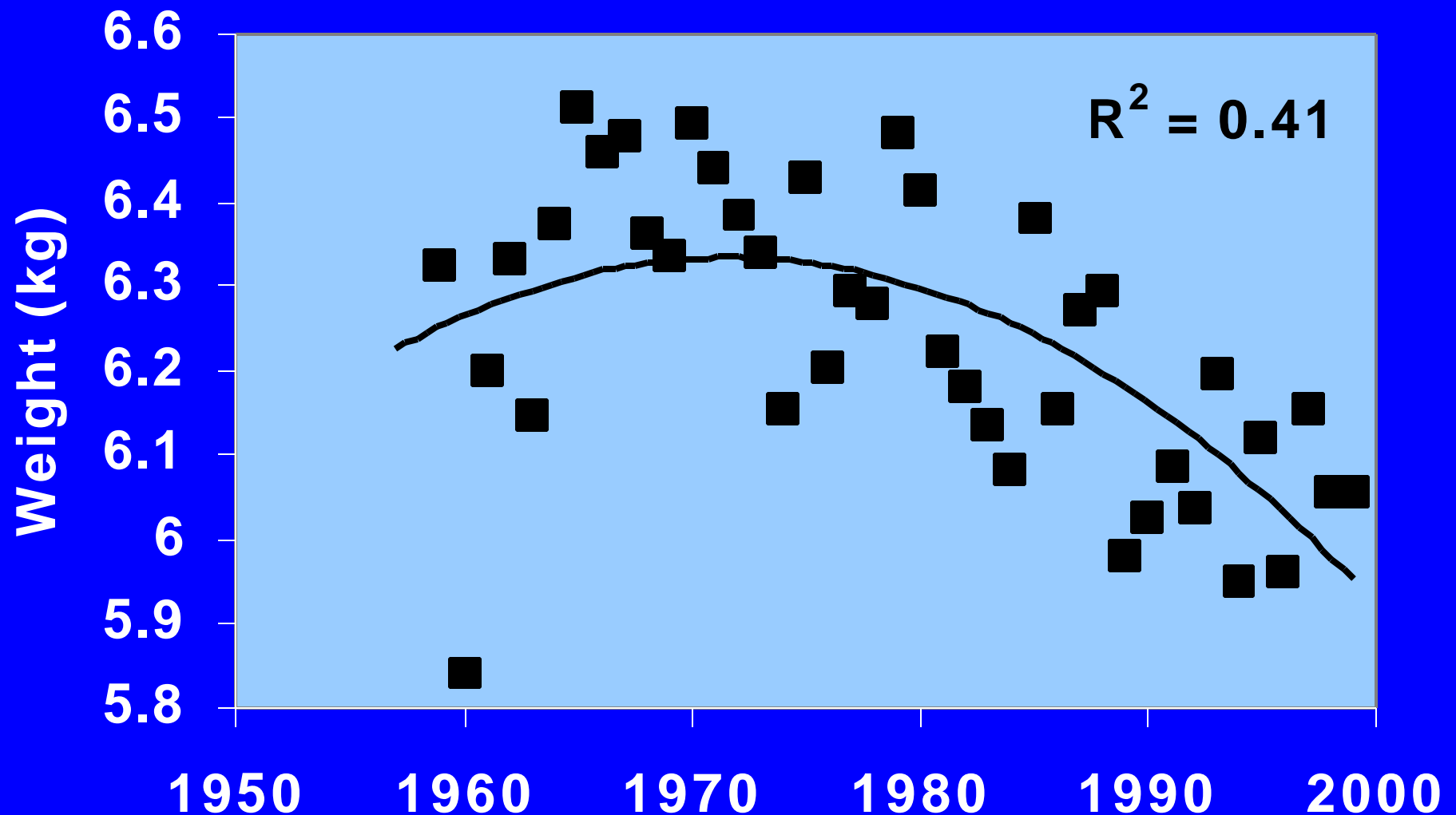
Length of male age 3 + UW chinook salmon



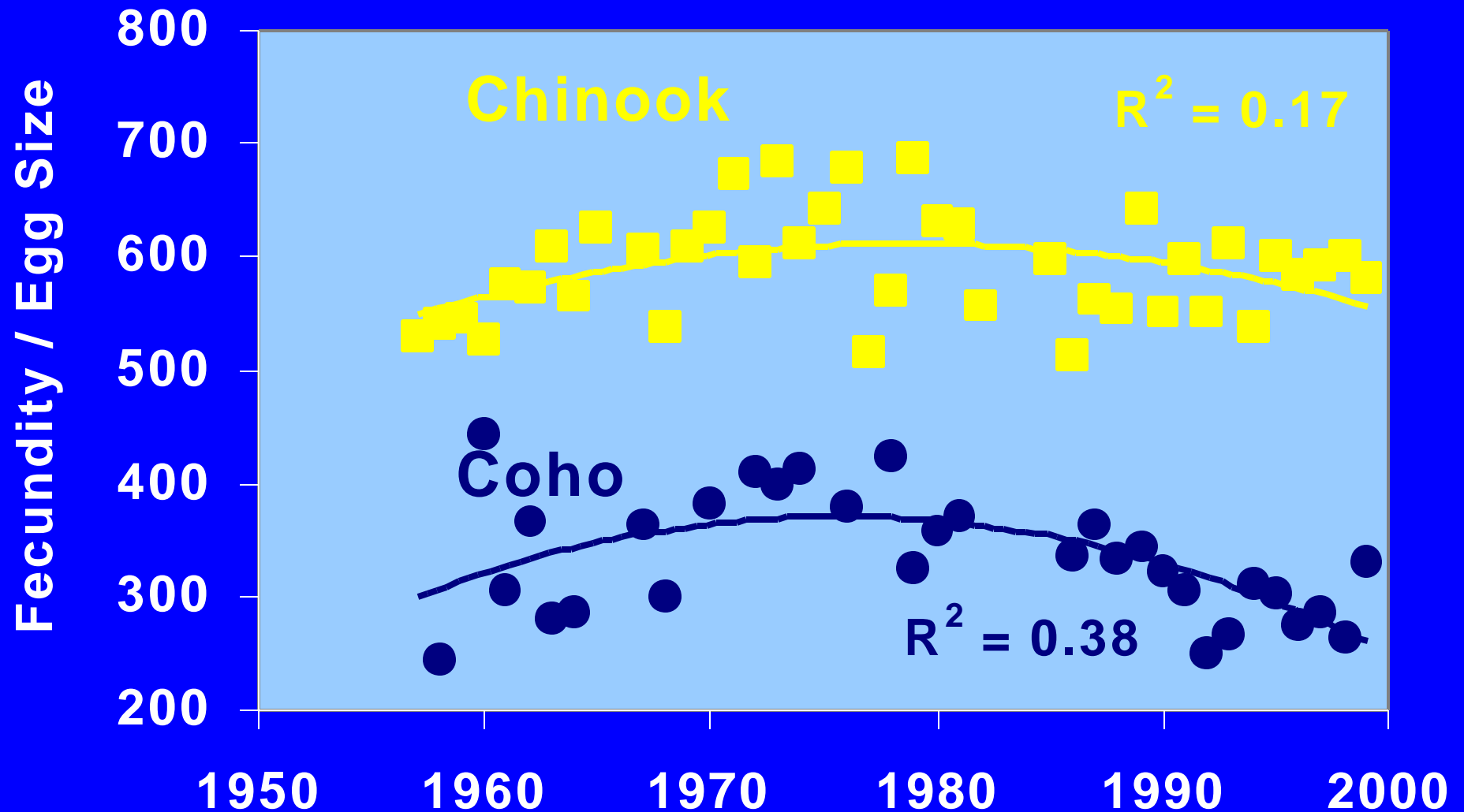
Percentages of male UW chinook salmon at different ages



Weight of UW chinook salmon at a standard length of 785 mm



Reproductive tradeoffs of UW chinook and coho salmon at standard lengths



Summary of Results

1. Spawning date advanced in both species
2. Coho length declined since the 1960s but the increased proportion of jacks may mask the trend in males
3. Coho condition declined after the late 1970s
4. As coho weight at length declined, fecundity decreased and egg size increased at a standard length
5. Chinook salmon have shown generally similar but less dramatic patterns

Interpretation

- 1. Spawning date reflects the conflict between warm summer temperatures and the need to reach smolt size in spring.**
- 2. Body size declines reflect growing conditions and selective fisheries.**
- 3. Females reveal the tradeoff between egg number and size, and the phenotypic effect of slow growth on fecundity.**
- 4. The combined effects on fecundity have serious implications for wild salmon.**

Future Research Directions

- 1. Examine survival rates of UW salmon**
- 2. Integrate smolt size and timing data with survival, growth and age composition**
- 3. Examine phenotypic traits in other populations**
- 4. Seek environmental correlates**
- 5. Plan experimental comparisons**

Hearty thanks to:

- 1. Jeff Richey and the PRISM program**
- 2. Doug Houck and Metro - King County**
- 3. The folks who collected all the data**
- 4. The salmon, who make this all possible!**